ORBIT AND RADIANT OF A SPORADIC FIREBALL IMAGED BY THE SPANISH METEOR NETWORK.

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Introduction: The development of a network of meteor observing stations allows for a continuous monitoring of meteor phenomena. One of the main goals of the SPanish Meteor Network (SPMN) is the analysis of the physico-chemical properties of meteoroids from multiple station data. This provides useful data to improve our knowledge about meteoroid streams and meteoroids of sporadic origin, so that we can reach a better understanding of the mechanisms that deliver these materials to the Earth. In fact, the orbits of large sporadic meteoroids are an important source of impact hazard on the surfaces of artificial satellites. We have started a continuous monitoring program in order to get very reliable orbital data of such a stochastic source to be able to improve models of the meteoroid flux in the near-Earth environment [1].

We currently operate 29 meteor observing stations in Spain. Most of them employ high-sensitivity CCD video devices, although low-scan all-sky CCD cameras are also used. In this context, we have imaged on April 17, 2011 a four-station sporadic fireball with an absolute magnitude of about -7±1. The analysis of this bolide is presented here.

Methods: The sporadic fireball considered here was simultaneously recorded by four SPMN meteor observing stations: Universidad Complutense (Madrid), Toledo, La Cañada (province of Avila) and La Hita Astronomical Observatory (province of Toledo). The latter one works in an fully autonomous way by means of proper software [2] and all of them employ high-sensitivity 1/2" monochrome CCD video cameras (Watec Co., Japan). A detailed description of these stations has been given elsewhere [3, 4].

Our software Amalthea has been employed to perform the astrometric calibration of the images [5, 6]. The atmospheric trajectory of the fireball was obtained by using the planes intersection method [7]. From the sequential measurements of the video frames and the trajectory length, the velocity of the bolide along the path was obtained. The pre-atmospheric velocity V_∞ is found by fitting to a suitable model the velocity values measured at the earliest part of the fireball trajectory.

Results and discussion: The mag. -7 fireball analyzed here (code SPMN170411) was imaged on April 17, 2011 at 22h11m32.2±0.1s UTC (Figure 1). The radiant and orbital parameters (J2000) of the fireball are shown on Table I. Orbital data reveal a 2:1 resonance with Jupiter. The preatmospheric velocity calculated from the velocities measured at the beginning of the meteor trail was V_∞=19.5±0.2 km/s. This event started its luminous phase at a height of about 85 km above the sea level, with the terminal point located at a height of about 38 km. The projection on the ground of the fireball's trajectory is plotted on Figure 3.

Radiant data			
	Observed	Geocentric	Heliocentric
R.A. (º)	24.38±0.10	35.85±0.22	-
Dec. (º)	68.86±0.15	63.27±0.20	-
Ecliptical longitude (º)	-	-	100.99±0.14
Ecliptical latitude (º)	-	-	17.13±0.25
V_∞ (km/s)	19.5±0.2	15.9±0.2	38.6±0.2
Orbital data			
a(AU)	3.2±0.1	**ω (º)**	144.0±0.2
e	0.71±0.01	**Ω (º)**	26.6031 ± 10^{-4}
q(AU)	0.924±0.001	**i (º)**	17.7±0.3
Q(AU)	5.5±0.3		

Table 1. Radiant and orbital data (J2000) for the sporadic fireball SPMN170411.

Conclusions: We are employing high-sensitivity CCD video cameras to monitor the night sky in Spain and neighbouring countries. These systems obtain radiant, orbital and physico-chemical properties of meteoroids ablating in the Earth's atmosphere. This continuous multi-station monitoring provides data that improve our knowledge about meteoroid streams and meteoroids of sporadic origin. The analysis of the mag. -7 sporadic fireball considered here has provided information about its atmospheric trajectory and the orbit in the Solar System of the corresponding meteoroid.

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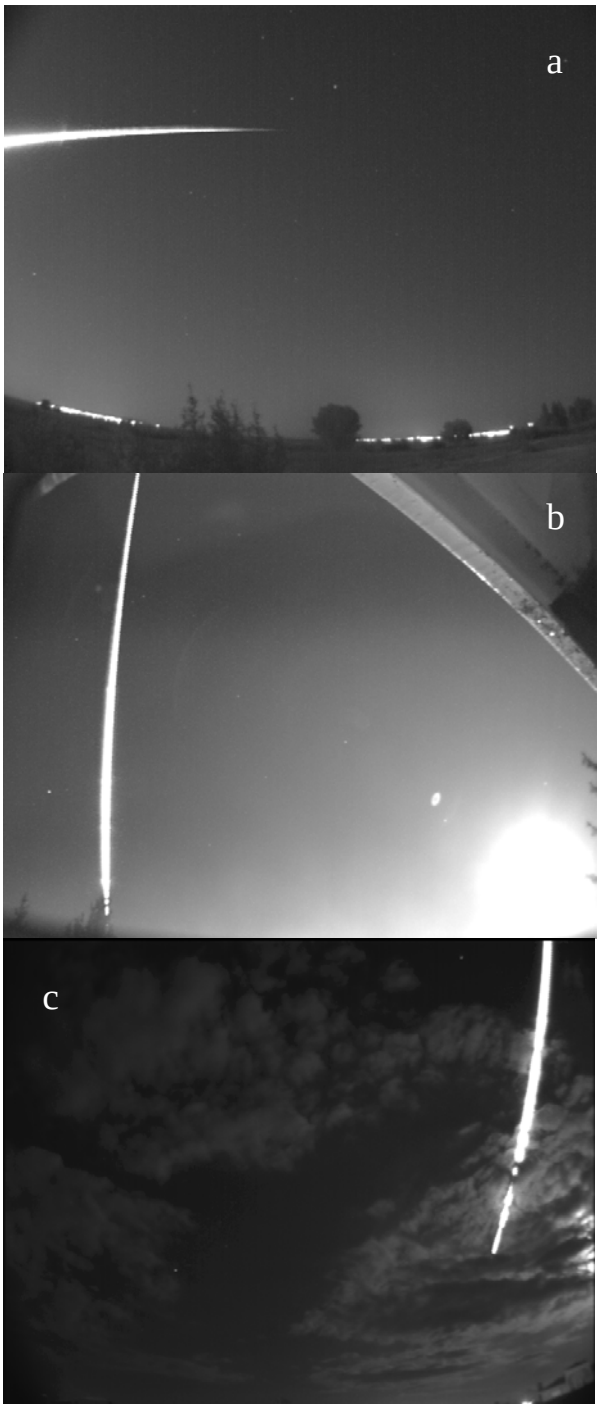

Figure 1. The SPMN170411 fireball imaged from a) La Hita Astronomical Observatory, b) La Cañada, c) Toledo.

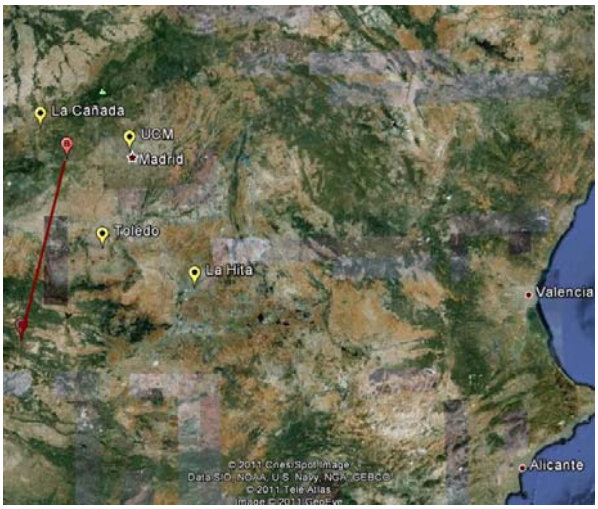

Figure 2. The trajectory projected on the ground of the fireball SPMN170411, where the location of the four video meteor stations that imaged it is shown.

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